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Scientific Research

Digital Storytelling for 21st-Century Skills in Virtual Learning Environments

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Abstract

This article finds that the new virtual learning environments comprise more spaces and practices in which digital resources, tools, and applications are used. The article introduces how digital storytelling can create virtual learning environments when it is used for learning 21st-century skills and competencies needed in students' future working life. The study describes how students (n = 319) in three countries and their teachers (n = 28) value digital storytelling and what they think students have learned. Their experiences are analyzed using a theoretical conceptualization of the global sharing pedagogy that sets categories of processes or tools as mediators: 1) learner-driven knowledge and skills creation, 2) collaboration, 3) networking, and 4) digital literacy. Analyses have been quantitative and qualitative. The article describes students' experiences when they created their digital stories and how they engaged in learning. The major findings are that students enjoyed creating their stories, and they were very engaged in their work. They learned many 21st-century skills when creating their digital stories.

Keywords

Digital Story Telling, Learning, 21st-Century Skills, Videos, Collaboration, Engagement

1. Introduction

The way to prepare a new generation for the future, its working life, and lifelong learning has become an urgent topic on the agenda of educational systems (e.g., Binkley et al., 2012). The European Union (2006) defined the most important core competencies, and the Organisation for Economic Co-operation and Development (Griffin, 2013; Griffin, McGaw, & Care, 2013), as well as many global organizations, identified the necessary 21st-cen-

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tury skills. The most important message is that schools must seek new forms of teaching and learning. Many discussions and documents have proposed ways to face the future and have delineated the roles of schools and teachers in these changing contexts (e.g., Bellanca & Brandt, 2010; Griffin, McGaw, & Care, 2012). Andreas Schleicher (2012) argued, "Everyone realises that the skills that are easiest to teach and easiest to test are now also the skills that are easiest to automate, digitise and outsource. Of ever-growing importance, but so much harder to develop, are ways of thinking-creativity, critical thinking, problem-solving, decision-making and learning; ways of working—including communication and collaboration; and tools for working—including information and communications technologies."

Technology-mediated learning environments have developed radically over the last years. They have become more interactive, synchronic, and flexible, and they connect different digitalized resources and tools for knowledge creation. Borders between users and producers are diminishing with new applications of publishing and sharing in virtual environments. This article introduces how digital storytelling (DST) can create virtual learning environments when it is used for learning 21st-century skills and competencies needed in students' future working life. This article claims that the new virtual learning environments constitute more spaces and practices in which digital resources, tools, and applications are used. Technology-enriched learning tools and spaces with mobile technology, Web 2.0 applications, social media, and all existing digital resources are providing powerful arenas for learning, both in formal and informal education settings (Multisilta, 2012). First, the article introduces the theoretical background of a model of global sharing pedagogy (GSP) as a basis for the DST project. Thereafter, the empirical results of DST applications in Finland, the USA (California), and Greece are presented, including both teachers' and students' perspectives. Finally, the discussion section reflects on pedagogical viewpoints on how DST can be a powerful tool for learning 21st-century skills.

2. Digital Storytelling as a Learning Environment

According to Jenkins et al. (2006), DST promotes 21st-century learning. When designing, shooting, and evaluating videos, the students acquire knowledge that is related to their video topics. Professor Glynda Hull at Berkeley University has extensive experience of using DST in different cultural contexts among young people who are in danger of dropping out. Her outcomes are very encouraging and give evidence that sharing experiences through student-driven videos is a highly empowering tool (Hull & Katz, 2006; Hull, Zacher, & Hibbert, 2009). Robin (2008) proposed that DST takes advantage of the creative potential of modern communication technologies. Students are encouraged to become creators, producers, and discussants, rather than simply passive audience members.

This article describes a project whose purpose was to promote students' 21st-century skills through DST. The aim was to create a virtual learning environment that connects formal and informal learning settings. An important goal was for students to learn collaboration and sharing in the virtual environment by designing products in groups and presenting them to others. Giving feedback and help, and seeking and giving strategies were integrated into the learning environment.

The students described in this article used the mobile video experience (MoViE) platform (http://www.finnable.fi/digital-storytelling.html) for creating and sharing collaboratively produced video stories in Finland, Greece, and California, USA. MoViE enables users to record video clips using their mobile devices (phones, tablets, digital cameras, etc.), upload videos to the MoViE website, and create video stories using all the clips they and their collaborators have taken (Multisilta & Mäenpää, 2008; Multisilta, Perttula, Suominen, & Koivisto, 2010; Multisilta, Suominen, & Östman, 2012; Tuomi & Multisilta, 2010, 2012). Existing video clips can also be remixed with new video stories. The content of the videos is not limited by the MoViE, but teachers have a right to moderate the process if they see that some videos are not in line with their schools' ethical principles. Teachers and students can create videos that fit their needs and support learning both in and outside the classroom. MoViE is a safe environment with authentication and content moderation features.

As a pedagogical method, DST is based on learner-centered approaches that can improve students' learning in multiple ways (Kearney, 2009; Yang & Wu, 2012). Here, learning is seen as a socially and culturally related process that takes place in the interaction between a learner and material tools, psychological tools, or other human beings (Vygotsky, 1978). With DST, all these forms of interaction can occur. Learners have a central role in exploring and building knowledge by using different kinds of material tools, such as mobile phones, computers, and the Internet. Additionally, students interact with psychological tools when using language, brainstorm-

ing, or creating stories. Learning together with others can take place when using collaborative methods and watching stories that other students have made. When planning and making digital stories together, students can become aware of their own knowledge and experiences and reflect on and share these with others. Watching other students' stories can also bring new perspectives to the topic and promote understanding about a certain phenomenon.

In DST, the stories are usually made with mobile devices that are easy to use and bring from one place to another. Thus, the method provides a possibility to expand the learning environment outside the classroom (Niemi & Multisilta, 2014b), where stories can be made in collaboration with different partners in a community, such as museums, libraries, or companies.

3. Global Sharing Pedagogy as a Theoretical Base for Digital Storytelling

The GSP model (**Figure 1**) has been a theoretical basis for learning in digital storytelling. An assumption was that video products are artifacts that challenge users to learn more and step outside of their earlier proximal zone of learning, and that media-sharing environments would add to learners' engagement (Lewis, Pea, & Rosen, 2010; Multisilta & Pea, 2012; Multisilta, Suominen, & Östman, 2012; Pea & Lindgren, 2008).

Learning is a mediated activity with tools, signs, and social interaction, according to Vygotsky (1978), who brought the idea of tools and symbolic and social mediators to the analysis of the learning process. Vygotsky defined the role of mediators as selecting, changing, amplifying, and interpreting objects to the learner (1978, p. 67). The GSP framework sorts mediators into four categories: 1) *learner-driven knowledge and skills creation*, 2) *collaboration*, 3) *networking*, and 4) *digital media competencies and literacies* (see **Figure 1**).

In *learner-driven knowledge and skills creation*, learners are provided with symbolic tools for the development of active learning methods and metacognitive skills. This is a dynamic process in which learners, guided by reflection and metacognition, manage their thinking and learning resources. Learners need strategic skills to manage their own learning and create new knowledge, individually and collaboratively (Nevgi, Virtanen, & Niemi, 2006; Pintrich & McKeachie, 2000). Schools and teachers should activate students to this kind of independent learning (Niemi, 2002; Scardamalia, 2002; Scardamalia & Bereiter, 2003). Mediation toward student-driven knowledge creation consists of different kinds of symbolic tools, such as critical thinking, creativity, argumentation, "learning to learn" skills, and ethics and values.

Collaboration is a social mediator that allows or requires students to work together (Hull et al., 2009; Pea & Lindgren, 2008; Rogoff, 1990; Wells, 1999). It ensures that students can learn and work in the global world in the future; they need to develop the following competencies beyond the purely "cognitive": social skills, cultural literacy and understanding, and help-seeking and help-giving strategies.

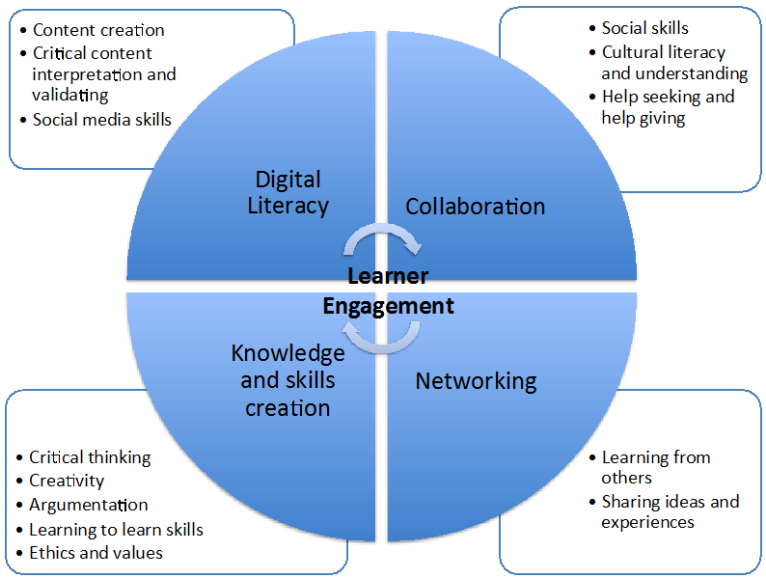

Figure 1. The concept of global sharing pedagogy.

Networking is also a social mediator that uses the synergy of the expertise of other people and provides tools for intercultural learning (Starke-Meyerring, Duin, & Palvetzian, 2007; Starke-Meyerring & Wilson, 2008). Learning is a continuous process of dialogical interaction with other people and cultural artifacts. In distributed cognitions and interaction with different artifacts, people bring remarkable value that enhances their learning and competencies. These processes are mutually constitutive. All learners are also contributors. Thus, networking means learning from others, as well as sharing ideas and experiences.

Digital media competencies and literacies serve mainly as a tool mediator that enriches learning through new technology environments, but they can also consist of social and symbolic mediators through different kinds of digital environments (Säljö, 2012). In technological environments, learners are both content producers and consumers. As such, they need the skills to study and work in digital environments. They must also assess critically and validate the knowledge they find and create; they must be accountable to the norms of discourse and argumentation established by the adult communities of practice in each discipline. They also need skills in creating and discussing social media and in promoting ethical behavior in these media environments. Mediation of digital media competencies and literacies consists of the following skills that schools should provide to students: content creation, with critical content interpretation and validation, and social media skills that are part of digital environments. In this study, the students used the MoViE platform as a DST tool (http://www.finnable.fi/digital-storytelling.html). MoViE is a mobile social media service for community-created videos (Multisilta, 2012; Multisilta & Mäenpää, 2008; Multisilta & Suominen, 2009; Multisilta et al., 2010). In MoViE, students collaboratively create stories with their mobile devices or video cameras and share them in a joint technological environment.

Mediators are seen as factors that promote *engagement.* Engagement has motivational qualities, including positive emotional experiences such as fun; students' aspirations and inspirations or enthusiasm; and commitment, or the ability to devote persistent work to a learning task. Technology is a tool that can motivate students and provide scenarios in which they can make their own unique contributions. This student-centered approach also means that learners can connect formal and informal learning settings and use them both as learning resources. In video creation, the students in this study created their own stories on a topic agreed on with the teacher.

Taylor and Parsons (2011) analyzed what student engagement might be. They introduced several types of engagement: academic, cognitive, intellectual, institutional, emotional, behavioral, social, and psychological. After exploring a number of definitions, they concluded that the following criteria characterize engagement: 1) learning that is relevant, real, and intentionally interdisciplinary—at times moving learning from the classroom to the community; 2) technology-rich learning environments—not just computers, but all types of technology, including scientific equipment, multimedia resources, industrial technology, and diverse forms of portable communication technology; 3) learning environments that are positive, challenging, and open—sometimes called "transparent" learning climates, which encourage risk taking and guide learners toward co-articulated high expectations (involving students in the assessment for and of learning); and 4) collaboration with respectful, "peer-to-peer"-type relationships between students and teachers.

4. Data Collection and the Context of the Study

Data was collected between September and November 2012. The student participants were at the elementary, lower, and upper secondary schools in three countries: Finland, the USA (California) and Greece. The total number of student participants was 319, with a balanced gender distribution of 159 girls and 160 boys. There were 28 teachers. Because grading schemes are not identical in different educational systems, the information was organized by age (see **Table 1**).

Most students were between 10 and 14 years old. Classes were selected on a voluntary basis. Researchers contacted potential schools and teachers who might be interested in participating in the study. There were no special requirements for a school to be eligible. Specifically, it was not required that the school be experienced in using technology; the only expectation was that students would have access to mobile devices (such as smartphones or tablets) or other video recording devices, either their own or borrowed from the school. Schools did not receive any extra resources for the project other than some pedagogical and technical support from the researchers during the project. At the outset of the project, the researchers demonstrated the use of the MoViE platform and how to create connections to a partner school.

Table 1. Participants of the study by country, age, and gender.

Country	Age											Gender		Total
	8	9	10	11	12	13	14	15	16	17	18	Girls	Boys	
Finland	16	2	37	19	45	21	27	17	4	1	3	110	82	192
Greece	7	5	1	36	28	17	10	7	0	0	0	49	62	111
California	0	0	0	11	1	4	0	0	0	0	0	0	16	16
Total	23	7	38	66	74	42	37	24	4	1	3	159	160	319

At the beginning of the project, the students were asked how often they used different technological applications. The responses from all three countries were between "never" and "less than once a week" for the following activities: editing video; making simulations or animations; composing, editing, or remixing music; or creating a computer game. Editing photographs or images was more common, but even this task fell under the category of "less than once a week." We can conclude that the students did not have real experiences with DST before the project.

5. Research Questions and Research Instruments

The DST project asked the following research questions:

1. How do topics of video storytelling connect formal and informal learning settings?
2. How do students and teachers value storytelling, and what did students learn through digital storytelling?

Data was collected from students and teachers using a survey asking what they have done and how they valued the learning activities in the project. The survey questions covered several features of mediators and engagement as they were presented in the theoretical framework of GSP. There were also questions about what the students had learned during the DST, as well as some open-ended questions about their experiences in the survey. After the project, 2 - 8 students in each class were interviewed in focus groups, and all their teachers were interviewed. All the videos were uploaded and stored in the MoViE platform, and they also provided research material. The interviews were semi-structured and had themes originating from categories of the GSP. They were implemented with a flexible discussion.

In this article, the GSP theoretical model is used as a basis for analysis. The results of the quantitative survey are presented under the main categories of mediators and engagement. In connection with these quantitative results, qualitative information is also provided. The topics of videos have been sorted according to whether they linked with school subjects or other themes in the students' lives.

6. Findings

6.1. How Do Topics of Video Storytelling Connect Formal and Informal Learning Settings?

The students created over 1000 videos altogether. Most of them were between 2 and 4 minutes in length. Schools and teachers had the freedom to choose how they wanted to use DST in their teaching. The major categories of the topics are as follows:

Connection with school subjects. Examples included language learning, physics, chemistry, biology, and history. In some classes, the topics were multidisciplinary. They could combine, for example, traffic education, language learning, and art in the topic. Video stories could also work as educational videos, where students taught other students to do something. This happened in one second-grade class; students made video stories in their teddy bear project, where they taught other students how to make different handicrafts.

School life from students' perspective. The students made a lot of videos where they told others about themselves and their school and country. Some of the classes had international collaboration, and they made videos that helped them get to know one another. In some classes, video stories were also used as video diaries, where the students and teachers told about everyday life or some special events in the school. In one class, the sixth-grade students included DST in their school trip and made video stories about the views and activities in their

trip. In one fourth-grade class, the students made video stories about how they came to school every day.

Free time and hobbies of the students. The students told about what they were doing outside the school. Many videos presented different hobbies, for example, sports, music, and playing. The videos could also teach how to learn some skills from the students' hobbies.

Important and current phenomena in society and schools. Many videos were linked with the environment and sustainable development. Recycling was a very popular DST topic in many classes. The students in one sixth-grade class made video stories about how to recycle different materials. In their videos, they also highlighted the importance of recycling and showed that it was easy and could also be fun. Students made video stories from their own perspectives, using their own voices and creativity.

As a summary, we may conclude that DST connected formal and informal learning in many ways. It integrated learning in schools with phenomena outside the school. Stories could be linked with school subjects, but themes could also cross boundaries between school subjects. Many stories were critical of societal issues and took a stand on inequity or racism.

6.2. How Do Students and Teachers Value Storytelling, and What Did Students Learn through Digital Storytelling?

6.2.1. Knowledge Creation

Students described their work as an active process in which they edited and used materials and information from outside the school for their projects. They discussed multiple viewpoints when creating their digital stories (**Table 2**).

In the interviews, the students described their experiences as follows:

Well, at first we planned how to do it. Then we explored knowledge. And then we searched for pictures. We thought it would get visible when we tell them about it. We wanted [*that*] *the one who watches it, would understand it.* (*a sixth-grade student*)

We tried to get it into one shoot. But still, we did it about four times. In four separate classes, because something went wrong in every time. Either the picture was upside down or someone started to laugh. (*a sixth-grade student*)

The project made the students seek new knowledge; they had to modify it to a new form in such a way that others could understand it. They had self-evaluated their products, and sometimes they had to revise them several times. In the process, we can find authenticity, connections to real life, and information searching and processing.

The teachers' descriptions about the students' work corresponded with the students' experiences. The teachers stressed that the students connected their projects to real-life issues and integrated their experiences and knowledge from different contexts (i.e., school and home). The teachers confirmed that the students pondered the contents and designs from several perspectives (**Table 3**).

Table 2. Students' evaluations of their knowledge creation in the DST Project (n = 319), 1 = not at all… 5 = very much.

Knowledge creation	M	SD
We edited our own work.	3.36	1.19
We discussed multiple viewpoints or perspectives.	3.19	1.27
We worked on our project outside of the classroom.	2.99	1.37
We used materials and information from outside the school in our project.	2.95	1.29
We connected our project to problems or issues in the real world.	2.84	1.30
We experimented with different ideas for our MoViE.	2.74	1.40
We used a variety of sources when planning and making our MoViE.	2.66	1.27
Working on our MoViE project was challenging.	2.36	1.15

Table 3. Teachers' evaluations of students' knowledge creation in the DST Project (n = 28), 1 = not at all… 5 = very much.

Students' knowledge creation	M	SD
Connected their projects to real-life issues.	3.82	1.05
Kept trying to find solutions to challenges.	3.61	0.99
Edited or evaluated their own work.	3.43	1.06
Discussed multiple viewpoints or perspectives before or during the MoViE project.	3.32	1.12
Created a reasonable plan for the MoViE story.	3.29	1.15
Integrated experiences and knowledge from different contexts (i.e. school and home).	3.18	1.27
Brainstormed and reflected on new ideas.	3.14	1.04
Used argumentation skills.	3.04	1.07
Looked at information they needed for the project with a critical eye.	3.04	1.17
Evaluated strengths and weaknesses of their own ideas.	3.00	1.15

In the interviews, teachers described students' work as follows:

For example, if you start to think—that—you have a topic. Then you have to think actively, which are the things here you want to emphasize and how you could highlight it. And all this requires that you work actively and think. And it absolutely activates you to think "how do I want to pass on this [*knowledge*] *to others.* (*a eight grade teacher*)

I think [*students learnt*] *planning in that sense that they probably noticed that making a plan makes it easier to work in a project.* (*an eight grade teacher*)

We can find that in the DST project students had applied many of those skills mentioned as 21st-century skills: planning, inquiring, seeking and pondering new solutions, thinking critically, and giving reasons to their choices.

6.2.2. Collaboration

The students worked in twos or in small groups. The aim of the project was that students would learn collaboration. Collaborative work requires that a group find methods of working effectively. The students reported (**Table 4**) that they had to set goals for their work, seek as a group how to complete their project, and make decisions on how to divide the project work. They also met challenges and tensions in the group. It was not always easy to overcome disagreements, but they also indicated that they learned to take the other group members' perspectives into consideration and found solutions to tensions. How to give and get feedback had been the most challenging task for the students.

In the interviews, the students described their experiences as follows:

It was nice to work in a group. I think it was fun and quite educational in a way that you learnt and teamwork strengthened. (*a sixth grade student*)

[*The most significant thing when working was*] *collaboration. That you can talk with somebody about what we are going to do and that kind of stuff.* (*a sixth grade student*)

We also learnt from the work of the other group [in our class]—We learnt and watched the complete works in the class after everything was done. (*an eight grade student*)

The teachers confirmed that the students worked in groups and solved problems (M = 4.00. SD = 0.94). They also negotiated solutions to disagreements (M = 3.57. SD =1.06). The teachers also reported that collaboration was not always easy for the students, and they recognized the students' urgent need for these skills in the future. Generally, the teachers' opinion was that the project facilitated collaborative learning activities (M = 3.25. SD = 1.35).

In the interviews teachers described students' work as follows:

[*Two students*] *worked twosome.—They were discussing together whole time. Hands were flailing, they were discussing what goes where. Thus I would say that collaboration and, I think, problem-solving* [*were learnt*] *as one part.* (*an eight grade teacher*)

Table 4. Students' evaluations of their collaboration in the DST project (n = 319), 1 = not at all… 5 = very much.

Collaboration	M	SD
We decided as a group how to complete our project.	3.83	1.15
In my group, we divided the project work.	3.71	1.06
My group overcame disagreements.	3.60	1.23
I tried to understand better someone else's perspective.	3.49	1.04
Making decisions in my group	3.23	1.18
Setting and achieving team goals	3.13	1.20
Sharing and developing ideas together	3.09	1.21
My group played around with ideas.	2.85	1.37
I sought help from my teacher when I had difficulties during our project.	2.74	1.27
I sought help from other students when I had difficulties during our project.	2.54	1.27
How to give and get feedback	2.52	1.43

When watching the works together, there might arise some 'wow' moments like how things could be done differently.—So I guess that—they may learnt something from others' works. (*an eight grade teacher*)

Social skills, collaboration skills [were learnt]. It's unavoidable that conflicts occur when working together when a schedule is tight and devices are not always easy to use. Then in these unexpected situations, the social competence is measured and I think that in those situations it develops. (*a fifth grade teacher*)

Collaboration has been an important mediator. It has enriched a process and a product. Learning from others has been valuable and students have learnt problem-solving skills in critical moments in the work. The teachers also admitted that they themselves needed more skills to organize group work and this kind of open, student-driven activity. The teachers emphasized that they would need more management skills.

Digital storytelling requires tolerance to uncertainly, technical skills, time management and skills for grouping students. (*a fifth grade teacher*)

[*Interaction and commenting others' videos*] *would need some support that the interaction would really take off.—You really have to think how to arouse interaction. (a sixth grade teacher)*

6.2.3. Digital Literacy

The students described what they had learned about technology in the DST project. Regarding the most important aspect they stressed that the project taught them to get and find help when they have technological problems. Digital literacy seems to be connected with collaboration and sharing (**Table 5**).

In the interviews, the students described their experiences as follows:

We had to look for information from Internet about the topic and then plan a bit that what we are going to do and make videos about. (*an eight grade student*).

At first we had to explore for how [*the candidates of local elections*] *use advertising in Internet and we also used these voting advice applications.* (*an upper secondary school student*).

I'm not very good with computers or uploading video clips and I don't have a clue how to add videos [to some platform]. I haven't edited videos, but I learnt it, at least with this software. (aninth grade student).

The teachers' evaluations of the students' work in the digital environment focused on pedagogical features and arrangements (**Table 6**).

Students and teachers evaluated that DST and mobile devices enhance students' learning. They learnt quickly to use the MoViE platform. Students described how they connected information searching from Internet with the video creation. When facing technical problems they had learnt to find answers online. Students also emphasized that they learnt to use computers in a new way and to use new mobile applications. Teachers described digital literacy connected with MoViE and DST from pedagogical perspectives. They described that it facilitated collaborative learning activities and fostered critical thinking which teachers saw important components of digital literacy. They saw as a value that it was moderate easy to integrate MoViE into their classrooms.

Table 5. Students' evaluations of their digital literacy in the DST project (n = 319), 1 = not at all… 5 = very much.

Digital literacy	M	SD
Get help from others when I am having a technology problem.	3.85	1.11
Find answers online when I am having a technology problem.	3.73	1.23
Use computer in a new way.	3.69	1.16
Use a new mobile application.	3.59	1.16
Help others when they are having problems with their computer or mobile device.	3.46	1.15
It was fun to remix videos with my team.	3.29	1.39
It was easy to learn to use MoViE.	3.29	1.23
It was a good tool for making and sharing digital stories.	3.17	1.36
It was a useful learning tool for me.	3.13	1.37

Table 6. Teachers' evaluations of students' digital literacy in the DST project (n = 28), 1 = not at all… 5 = very much.

Digital literacy	M	SD
Use mobile devices in the classroom to enhance student learning.	4.07	0.85
It encouraged learning outside the classroom.	3.71	1.30
Fix technical problems that might arise in class.	3.71	0.97
I learned to use it quickly.	3.54	1.23
I found MoViE useful for teaching and learning.	3.43	1.28
I liked using MoViE.	3.39	1.25
I found MoViE easy to use.	3.32	1.24
It facilitated collaborative learning activities.	3.25	1.35
It was easy to integrate MoViE into my classroom.	3.04	1.03
I will use MoViE again.	3.00	1.54
I was able to use it to design activities that fostered critical thinking.	3.00	1.18
It was time consuming to plan the MoViE activity.	2.82	1.18
It helped me to engage students with the curriculum.	2.75	1.14

6.2.4. Networking

The aim of networking was to have active collaboration across the three countries in the study. This networking could be implemented only in 8 classes. Many factors made it difficult: to get timetables fixed, to obtain permission from the local authorities to implement the project, and to match same grade levels.

The students' evaluations (**Table 7**) illustrate the reality. There were little communication and interaction across three countries. All means are very low and standard deviation high. If there were communication between classes, it was seen very valuable.

In the interviews, the students described their experiences as follows:

In international collaboration, it was fun when you could see how they make the videos in other country—You could compare yours videos with their videos. (*a sixth grade student*)

The teachers' responses confirmed the students' experiences (**Table 8**). Teachers described also that international communication and networking were inspiring to students.

Table 7. Students' evaluations of their networking in the DST project (n = 319). 1 = not at all… 5 = very much.

Networking	M	SD
I learned what life is like in their hometown.	2.31	1.40
I learned how subjects are taught in their school.	2.27	1.34
I interacted with students from other schools.	2.26	1.48
I learned how they use technology for learning in their school.	2.26	1.32
I communicated with students from other countries.	1.86	1.26

Table 8. Teachers' evaluations of students' networking in the DST project (*n* = 28). 1 = not at all… 5 = very much.

Networking	M	SD
It provided opportunities for learning through networking.	3.36	1.25
Communicated with students from other countries.	1.82	1.18
Interacted with students from other schools.	1.75	1.20

In the interviews teachers described students' networking as follows:

You could see that the videos from California interested children much, but there is a need for guidance that would support interaction [*between children from different countries*]. *There were plenty of different kinds of videos and the ones that were very fun were also most commented.* (*a sixth grade teacher*)

It somehow inspire children when doing same kind of things in different places and you can see that how it looks like there—It is somehow thought-provoking. (*a pre-school teacher*)

That kind of awareness that this life or world is very wide. That it doesn't occur only in this town but also on the other side of the world. They are living there in a very same way, they are laughing at same kinds of things. It broadly brings communality with the whole world. (*a pre-school teacher*)

We may conclude that both students and teachers valued international networking. However, there were very little real opportunities to create collaboration between classes in different countries. In addition to many practical arrangements, it was challenging to get the project combined with other activities in schools' daily life. There were some excellent examples and they encourage to continue networking in the future.

6.2.5. Engagement

By the definition "engagement" in this study included two important components: enthusiasm with fun and commitment to hard work. It seems that students had a lot of experiences of fun in the project. They learnt new things and they were inspired to work hard in the MoViE project (**Table 9**).

In the interviews the students described their experiences as follows:

It was fun to work with friends in the group. It was somehow fun, you could choose the topic yourself and teach something new to others. (*a fifth grade student*)

Yeah, this is more fun than normal studying. (*an eight grade student*)

It was fun because it was a bit different than normal studying. This kind of activity could be done more often. (*an eight grade student*)

Teachers' evaluations can be seen in **Table 10**.

In the interviews, teachers described students' work as follows:

There were no problems in motivating students—but maybe I had to guide a bit [*to focus on the activity*]. [*When working*] *some students were thinking to leave to eat hamburgers. Together we then discuss what they were going to do there and how they were thinking to present it* [*in the story*]. *After all, they made very good videos about cycling and basketball.* (*an eight grade teacher*)

Making the videos motivated [students] straight away.—[*Problems in motivation may occur*] *if someone wants to take the easy way out. In those cases, motivation of students may have somehow failed if they don't*

Table 9. Students' evaluations of their engagement in the DST project (n = 319), 1 = not at all… 5 = very much.

Engagement	M	SD
It was fun.	3.82	1.23
It was a different school experience.	3.74	1.27
It combined schoolwork with fun.	3.61	1.32
I had many new ideas.	3.38	1.37
I learned new skills.	3.36	1.33
I liked using MoViE.	3.23	1.3
I was inspired to work hard on the MoViE project.	3.23	1.21
I would like to use MoViE again for another project in the future.	3.13	1.47

Table 10. Teachers' evaluations of students' engagement in the DST project (n = 28), 1 = not at all… 5 = very much.

Engagement	M	SD
Were genuinely interested in their MoViE projects.	3.71	1.08
Enjoyed doing their MoViE activities.	3.61	1.22
Took responsibility for their own work.	3.75	1.04

[*want to give their best effort*]—*or maybe they didn't just find out a way, how to bring out* [*their topic*] *in school.—I believe that motivation for this kind of activity arises from feelings of success. When students, working in a group, can see what kinds of things produce feelings of success, I think, that it can somehow generate a spiral that promotes it forward.* (*an eight grade teacher*)

Students and teachers gave very positive comments about students' motivation. Feelings of success have been an important factor. Students told that setting own goals is an important condition for committed learning.

7. Discussion and Conclusions

The findings give evidence that students enjoy creating videos. They work actively, seeking new knowledge and constructing their videos using different information sources. A general picture that emerges is that they also self-evaluate their work. It can also be observed that commenting on others' work is difficult for students. Giving and receiving feedback is not self-evident. Although students find it interesting to watch others' videos, making active comments is still fairly rare among them.

The process in a group work is important but not necessary without tensions. It can be noted that collaboration demands practice and learning about decision-making processes, and different viewpoints and perspectives should be taken into consideration.

Another project aim has been for the students to work across countries. It has not been easy to get two or even three classes at the same grade levels from the three participating countries to work together, although all the technical arrangements have been provided. The MoViE platform offers user-friendly tools to create a joint group and share videos among group members. Despite this advantage, the different educational systems with various curricula structures and timetables have been identified as the factors that prevent networking. However, the most important issues are how much freedom the teachers and students have to take topics outside the curriculum and how they can integrate digital storytelling in their daily work. These are cultural issues that concern the entire school community. Virtual learning environments are open and provide a broad range of opportunities, but the question is whether there is space in schools to utilize them. Another important condition involves the teachers' skills to use these environments. In the interviews, some teachers admit their need for technological skills to use new tools and applications, as well as their need for new pedagogical skills in how to organize work, with various options in student-driven knowledge creation. If teachers need new skills in open virtual environments, so do students.

Although definitions of 21st-century skills vary, there are some commonalities. The most important factor is that students should have the capacity to learn throughout their lives, and that education should provide the skills and mental tools to enable them to do so. Inquiry and knowledge-creation abilities are the most crucial, but they should be connected with analytical and critical thinking skills, as well as creativity. Students should have the capability to ask questions, not simply seek or repeat ready answers. They need the ability to work independently, but also increasingly, collaboratively. Life is ever more bound up with technology; learning environments are continuously changing, and information and communication technology provides many new learning opportunities.

A research group that studied future work (Davies, Fidler, & Gorbis, 2011) summarized the following skills as being the most important in the future: sense making, social intelligence, novel and adaptive thinking, cross-cultural competency, computational thinking, new-media literacy, transdisciplinarity, design mindset ability, cognitive-load management, and virtual collaboration. Skills and abilities will be related to higher-level thinking, and social relationships that cannot be easily transferred to machines, and which will enable us to create unique insights, will be critical to decision making. Workers will require social skills that enable them to collaborate and build relationships of trust locally, as well as globally, with larger groups of people in a variety of settings. Digital storytelling provides the learning environment for learning these skills needed in the future. This learning environment is open and boundless. Digital stories can be designed using different technical devices, such as mobile phones, iPads, and cameras. They can be applied to be closely related not only to school subject matters, but also to many other themes that are important to students. Topics can be personal, societal, historical, or related to any current issue that is regarded as vital or interesting for further understanding. The MoViE platform used in this study has been chosen as safe and user friendly for school.

This study's theoretical framework is based on sociocultural assumptions. Views of social perspective theorists can be diverse (e.g., Cole & Cigagas, 2010; Derry et al., 2010; Hakkarainen et al., 2013; Pea, 2004; Säljö, 2012). However, each theorist posits that learning occurs through the mediation of social interaction, and learning happens as a result of dialogical interactions among people, substances, and artifacts. This study finds that the digital technological environment of MoViE and video products are artifacts or tools that challenge users to learn more, and learning is a spiral-like process in which knowledge creation, collaboration, networking, and digital competencies and tools are in a dialogical interaction. Students learn in collaborative processes when producing videos and sharing them with other learners. However, they also increase their skills and competencies all the time when working with digital stories. Roger Säljö (2004, 2012) stated that when we are learning, we also make an impact on tools and learning environments, and it changes our learning. Rather than use the terms *acquisition* and *representation* in connection with learning, social perspective theorists regard knowledge as constructed by, and distributed among, individuals and groups, as they interact with one another and with cultural artifacts such as pictures, texts, discourse, and gestures. The DST project has found that many of the so-called mediators are not in a ready phase or completed. In collaboration, there are tensions and disagreements, and they force students to seek solutions to the challenges in division of labor and decision making. In the technological environment, technical problems or security issues sometimes prevent easy uploading of videos. Students have to learn to ask and give help. All these aspects of the processes interact when we try to achieve something, a next step in proximal development. This study has aimed to engage students in learning, which can be considered as one of the most powerful ways of sustainable learning later in life. In the larger picture, engagement can also be regarded as a mediator for high learning outcomes.

Earlier studies had tentative, quantitative results about the interrelationships and interactions of the mediators (e.g., Niemi & Multisilta, 2014a). They gave strong support of DST's powerful effect on students' motivation and enthusiasm, including both fun and commitment to hard work. The strongest predictor of the mediators of engagement is the MoViE platform, which provides an opportunity to create, shoot, and remix one's own story in collaboration with a peer group. The second strongest predictor is collaborative group work. Students learn in collaborative processes when producing their videos.

This study shows that students enjoy creating digital stories, and they are engaged in theory work. However, they still need more skills in collaboration, opportunities for networking, and teachers' guidance in knowledge creation and digital competencies. The limitation in this study is the uneven representation from the three countries. There are differences among the countries, but we cannot make real conclusions about these differences. In further studies, it is important to probe deeper into contextual issues and gain a more comprehensive understanding about pedagogical solutions in classrooms. In the future, it is also essential to create stronger interna-

tional networking and ensure continuity of international collaboration. It is also crucial to follow up on how students develop their skills in digital storytelling and how this kind of virtual space expands and connects digital storytelling with other digital resources and tools.

We conclude with the teachers' comments on the project:

[*In the project, it was learnt that*] *a teacher is not always there and say how things are done and what are the right answers. Pushing to think is hard but very important. I would say that these are the skills that they are going to need also in the future, such as how to search knowledge, how to manage it, how to view it from different perspectives, and how to share it with others.* (*an eight grade teacher*)

[*The project taught*] *at least that* [*students realized they can*] *be the ones that produce knowledge. That—they have some knowledge and they know how to share it with others. Not always that a teacher has the knowledge and shares it with students, but more like they can also share it with each others. (a sixth grade teacher)*

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